

Chromosomes of the Funnel-web Spider *Agelena limbata* (Araneae: Agelenidae)

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鶴崎展巨¹⁾・井原 庸²⁾・有田立身³⁾: クサグモ
(タナグモ科) の染色体

Abstract The number of chromosomes of the funnel-web spider *Agelena limbata* is reported to be $2n=42$ ($40+X_1X_2$) in males and 44 ($40+X_1X_1X_2X_2$) in females based on the observation of three populations from western Honshu, Japan. These numbers do not conform to those reported by SUZUKI (1954) where the diploid number in male was interpreted as 44 ($42+X_1X_2$). The disharmony in chromosome number between the two results may be attributable to the possible miscounting in SUZUKI's observation. Unlike previous reports on chromosomes of *Agelena* and most of other genera of spiders, *A. limbata* was shown to have some pairs of meta- or submetacentrics in its karyotype.

Agelena limbata THORELL is a species of spiders that construct sheet-funnel webs on low vegetation and bushes and is distributed in eastern part of the Continental Asia (Myanmar, China, and Korea) and Japan (YAGINUMA, 1986).

Chromosomes of this species were first studied by SUZUKI (1954) based on the specimens collected from three localities, Iwakuni, Mitaki, and the former campus of Hiroshima University, all of which are located in and near Hiroshima city, western Honshu, Japan. The number of chromosomes reported was $2n=44$ and $n(I)=21+X_1X_2$ in males. However, one of us, T. ARITA recently found that the spiders collected from Tottori city, about 200 km northeast of Hiroshima city, show $2n=42$ and $n(I)=20+X_1X_2$ in males.

There are two possible explanations for the discrepancy between the two results. First, the number reported by SUZUKI (1954) using paraffin section of testes may be incorrect. As was stated in his paper, it has been rather difficult to determine the chromosome number of the species accurately because of its large number that exceeds 40. In his observation spermatogonial metaphases actually showed 42 to 44 elements, though he concluded the number to be $2n=44$ with some hesitation. Secondly, the discrepancy may be a result of geographic differentiation in the chromo-

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Accepted May 24, 1993

some number of the species. Dispersal of *A. limbata* is likely to be restricted within a very small range due to its high tenacity on a web site (TANAKA, 1989, 1992). Therefore, this species might be more susceptible of genetic differentiation among populations than other spiders with no webs or webs of lower costs.

To disclose the truth, we reexamined chromosomes of the specimens of *A. limbata* from three places in western Japan, including Mitaki, Hiroshima, from which a part of the original materials was collected by SUZUKI (1954). The results supporting the first explanation presented above will be described here with figures of the karyotype.

Materials and Methods

The cytological data were mainly obtained from air-dried preparations of testes or ovaries of juveniles of final (6th) instar and adults just after final molting. The specimens used for chromosome examination are listed in Table 1. The technique used is described in TSURUSAKI (1985) and TSURUSAKI and COKENDOLPHER (1990).

Results and Discussion

Table 1 summarizes the results of our observation. Diploid number counted for males ranged from 40 to 43. Of these, we concluded that 42 is the standard number of males for all the present populations of *A. limbata*, since it was invariably shared by more than 90% of cells observed in each individual (Fig. 1A). The number of chromosomal complements at the first meiotic metaphase was determined to be 22 although a few variants with 23 to 24 complements were also observed. A set of 22 complements consisted of 20 autosomal bivalents and two univalent X chromosomes, X_1X_2 (Fig. 1B). There was no difference in chromosome number among populations.

We failed to obtain chromosomal spreads from females, except for one cell of a female from Yagi population. The number of chromosomes exhibited by the cell was, however, clearly counted as 44, which can be interpreted as a set of 20 pairs of

Table 1. Chromosome numbers in three populations of *Agelena limbata*.

Locality	Date	No. indiv. observed ¹⁾	Number of chromosomes			No. of modal cells (♂/♀) ²⁾
			male		female 2n	
			2n	n(I)		
Koyama (Campus of Tottori Univ.), Tottori, Tottori Pref.	16 June 1990	5j (♂)	42	20+X ₁ X ₂	—	18/—
Yagi, Asa-Minami-ku, Hiroshima, Hiroshima Pref.	26 June 1990	4♂♂4j (3♂♂1♀)	42	20+X ₁ X ₂	44	4/1
Mitaki, Nishi-ku, Hiroshima, Hiroshima Pref.	4 July 1990	8j (♂)	42	20+X ₁ X ₂	—	24/—

1) j=juveniles. Some female specimens in which no chromosomal spreads were obtained are not included here (1♀, 2♀♀, 3♀♀ for Koyama, Yagi, and Mitaki, respectively).

2) Number of cells with modal chromosome number at mitotic metaphase.

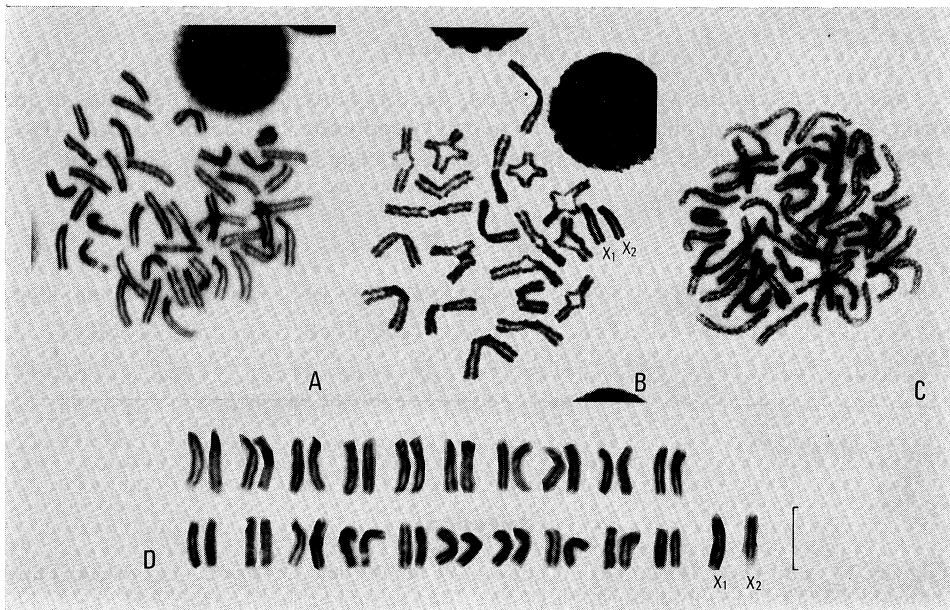


Fig. 1. Chromosomes of *Agelena limbata*.—A, Spermatogonial metaphase, $2n=42$ (Koyama, Tottori); B, Diakinesis, male (Yagi, Hiroshima); C, Mitotic metaphase, $2n=44$, female (Yagi, Hiroshima); D, Male Karyotype based on the photo shown in A. Scale= $10\text{ }\mu\text{m}$. All photos printed to scale.

autosomes and two pairs of X chromosomes, $X_1X_1X_2X_2$ (Fig. 1C).

We cannot perfectly discard the possibility that the number of chromosomes of *A. limbata* varies geographically since we did not reexamine two (the former campus of Hiroshima University in Hiroshima city and Iwakuni, Yamaguchi Pref.) out of three populations from which some materials were collected in SUZUKI's research. However, we prefer to set aside the possibility of geographic variation as no data to support it were available in our survey. Thus, we consider that chromosome number of *A. limbata* should be corrected as $2n=42$ (40 autosomes + X_1X_2) in males and $2n=44$ (40 autosomes + $X_1X_1X_2X_2$) in females. These numbers, $2n=42$ in males and 44 in females, have been reported also in *Agelena auclandi* BURMAN from India (DATTA and CHATTERJEE, 1983).

Karyotype: Chromosomes of a male mitotic metaphase plate are serially arranged in Fig. 1D. This figure and the description made here should be regarded as tentative since two X chromosomes can never be discriminated with confidence.

The autosomes seem to consist of 14 pairs of telo- or acrocentrics (Nos. 1–4, 6–13, 19–20) and 6 pairs of meta- or submetacentrics (Nos. 5, 14–18). A pair of chromosomes (No. 14) has a secondary constriction on their long arms. Possible two X chromosomes are telocentrics. The fact that some complements show meta- or submetacentric configurations is remarkable since no such chromosomes have been reported in *A. limbata* as well as other species of *Agelena* (SUZUKI, 1954). Further reexamination using current air-drying methods seems to be needed also for other species of *Agelena*.

Acknowledgments

We are grateful to Miss Noriko AOKI, Tottori University, for her help in preparing photoprints. This work was partly supported by Grants-in Aid (Nos. 02854100 and 04740429) from the Ministry of Science and Culture, Japan to N.T.

摘 要

本州西部の3集団を材料としてクサグモの染色体を観察した。染色体数は♂ $2n=42$ ($40+X_1X_2$), ♀ $2n=44$ ($40+X_1X_1X_2X_2$)であった。従来知られていた本種の染色体数 ♂ $2n=44$ ($42+X_1X_2$)はおそらく誤りと思われる。本種の核型にはクサグモ属および他の属のクモではほとんど知られていない中部動原体型あるいは次中部動原体型染色体が数対含まれることがわかった。

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